Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Convex optimizations for quantum state and process tomography ANDREW DOHERTY, ALEXEI GILCHRIST, The University of Queensland — Verifying the performance of quantum information processing devices is one of the key challenges facing the field of quantum information science. In optical approaches it has been possible to perform both quantum state and process tomography to completely characterize state generation techniques or quantum logic gates. However, the data reduction required is lengthy and error analysis has been ad hoc beyond two-qubit state tomography. We describe convex optimizations for quantum state and process tomography; these correspond to both the standard maximum likelihood reconstruction and to minimizing the trace distance between the observed and reconstructed probability vectors. We describe error analysis procedures for these algorithms and offer physical interpretations for the Lagrange dual optimisations. These algorithms are several orders of magnitude faster than existing techniques, opening possibilities including adaptive tomography techniques based on identifying which observables are currently limiting the tomographic fit.

Andrew Doherty
The University of Queensland

Date submitted: 07 Dec 2004 Electronic form version 1.4